What should colleges do with their outmoded science buildings?

RECOVERING FROM SPUTNIK

Robert Schaeffner

On October 4, 1957, the Soviets launched the first artificial earth satellite, called Sputnik. The achievement startled many in the United States. Reacting to the Soviet space advance, the U.S. government rapidly took a series of initiatives to improve mathematics and science in America. One of the initiatives was the funding of new science facilities on college and university campuses across the country. The idea was to construct cost-effective buildings as quickly as possible to regain a scientific advantage.

The result is that numerous colleges and universities have a science building from the Sputnik era, roughly 1958 to 1968. The buildings are nearly the same in layout, materials, and systems, and often have a similar image. The buildings' exteriors reveal the rational order of that period, usually with exposed structural slabs and columns. Many of the structures used pilotis, or columns that hold up the first floor (as opposed to a solid grounded base), and give an illusion that the building is defying gravity. Frequently, the buildings had small windows that provided only minimal daylight.

The floor plan layouts and circulation systems were usually of two types. One type is the single offset corridor with a staircase at each end, creating a single, narrow support zone along one side and laboratories/offices along both outside walls. The other type is the "racetrack" corridor with four staircases, one in each corner. In this type the core and perimeter spaces vary in width and depth and have sporadic support spaces. Although there was logic in the layout of the floors, there was little flexibility built in to make changes.

Also, architects gave little attention to the culture of the buildings' users or their programs. And the Sputnik-era science buildings were often constructed of inexpensive materials and stripped of details that might have added character to the buildings. In those days the buildings did not need to help attract students interested in science. The pedagogy of the day used a passive learning approach, so there are large lecture halls and labs oriented to standardized experiments.

Today, these Sputnik-era science structures are hopelessly inadequate and no longer functional. The mechanical systems of these buildings have a life span of 30 to 35 years, and the systems are failing. Every college and university needs to find a way to make them functional according to today's requirements. Some institutions have already done so, but others need to decide whether to do minor renovations, extensive renovations, or new construction.

Moreover, the modernization of the science buildings must be done when there is little government or industry funding for such renovation or new construction, and the costs to rectify the problem are extraordinarily high. However, reasonable solutions can be developed through careful, creative facilities and financial planning.

Conditions Have Changed

Colleges and universities have little choice. The quality of an institution's science facilities has a considerable impact on enrollments and on the recruiting and retention of science faculty. The

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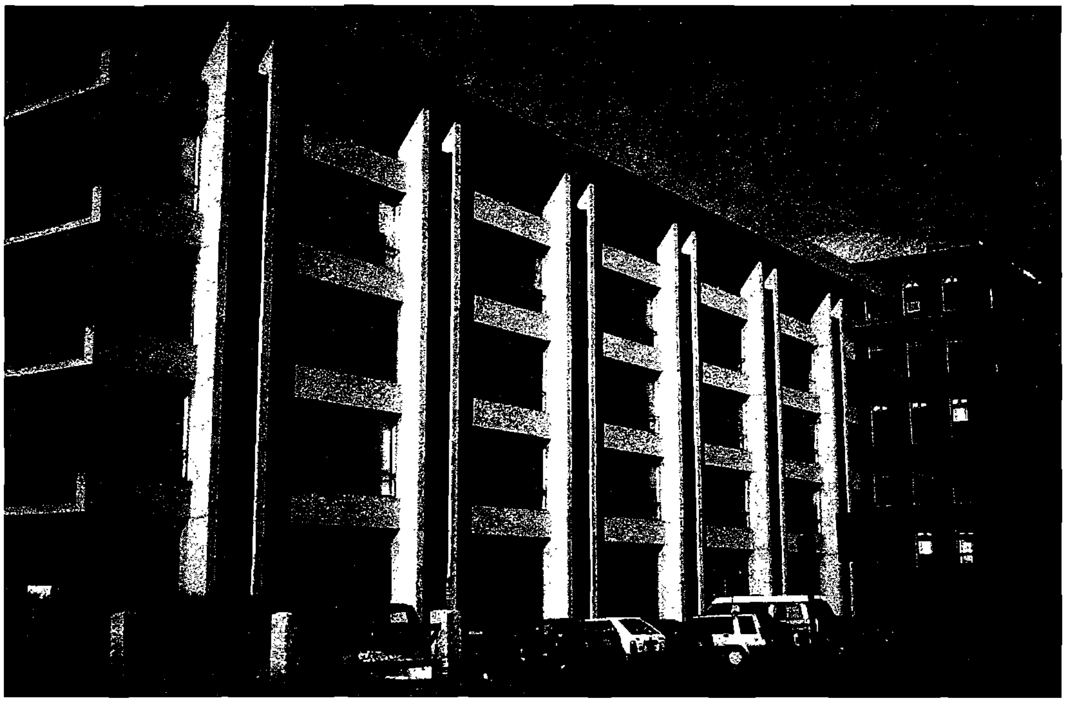


Many institutions constructed science buildings during the Sputnik era. The Hoffman Building at Harvard University is a typical example in its layout, materials, and systems.

number of undergraduates majoring in science has decreased, and institutions need to counteract this trend by attracting more students into the sciences (Laws 1997). Better facilities can be a huge help.

Then too, teaching methods have changed in the sciences. There is a more active, hands-on pedagogy, which uses technology more extensively. Space and wiring for computers and audiovisuals must be added. Numerous colleges have increased the amount of undergraduate research, emphasizing discovery over rote memory. There is more interaction between faculty members and students, and more collaboration among faculty in different departments. The cubicles of the 1960s are no longer appropriate.

There are pressing problems also with undersized and failing mechanical systems. The Sputnik-era buildings do not conform to current standards or to the Americans with Disabilities Act (ADA), which requires access to all parts of a building for every citizen. Other vital concerns include safety issues (lack of sprinklers and fire code conformance), slow elevators, inefficient energy use, low floor-to-floor heights, minimal loading capacity, small bay spacing, and outdated laboratories. The older science buildings paid little attention to vibration control or to adequate fume hoods and ventilation. No wonder that campus leaders have named the upgrading of science and engineering facilities as their top priority in physical facilities (Biehle 1996).

How should colleges and universities think about upgrading their Sputnik-era science and engineering facilities? Based on my work at more than a dozen campus science, medical, and research buildings and my discussions with other architects in the field and with campus administrators, I believe an essential first step is for each institution to develop a clear sense of objectives for academic science at its campus.

Too often, institutions begin the modernization because of a need for repairs, the necessity of correcting legal and code violations, or a failure of the mechanical system. Dollars are set aside in the budget to solve the obvious problems, but no plan is created for addressing the new conditions of contemporary science instruction and research. Once a Band-Aid solution is executed, it is unlikely that subsequent renovations will be undertaken until several years later. That is, a quick response to failures in the old science buildings can actually inhibit the introduction of necessary construction for 21st century science instruction and discovery.

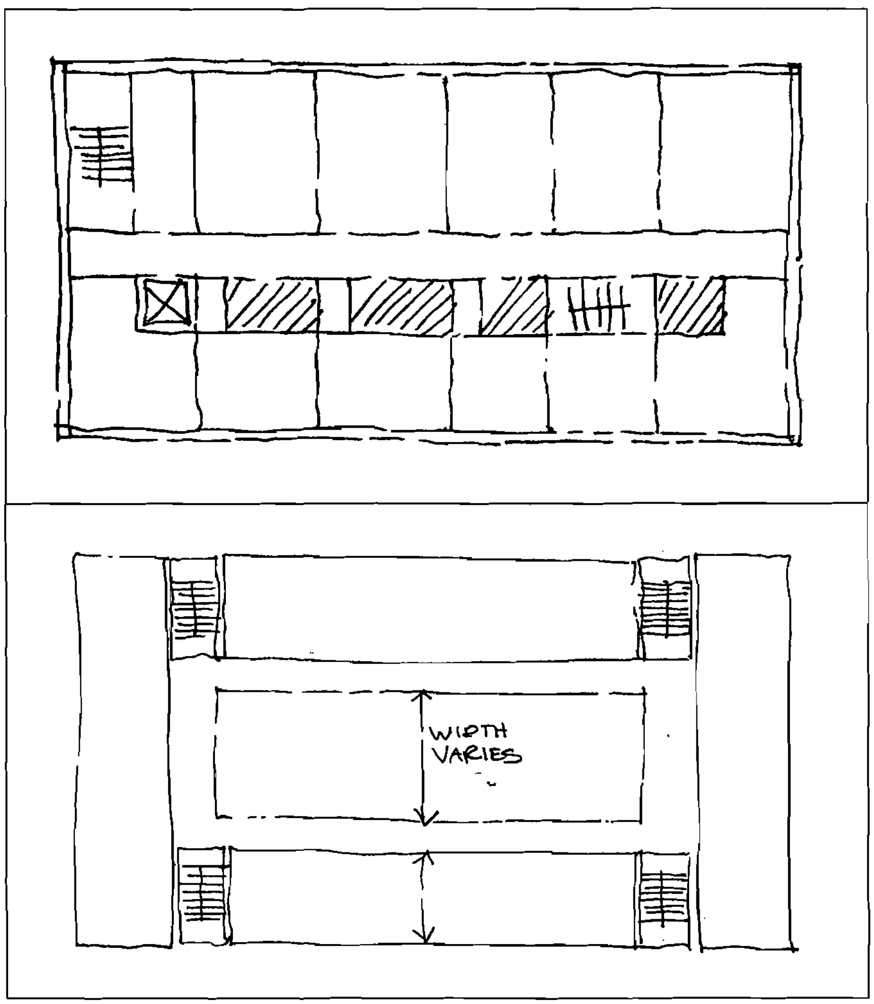
Use of a knowledgeable architect, working with the campus director of facilities, can be a real help in formulating a proper plan rather than a patch-up. Following the campus statement of objectives for academic science, the architect can devise a building program that identifies the new needs, qualitatively and quantitatively, of the departments to be included in the project, including the anticipated teaching methods, increased instrumentation space, and special research laboratories. Interaction spaces for informal learning and conversation can be identified in the program as well.

Depending on the quality and size of the old building and the college's plans for science, engineering, and research in the next decades, the campus leaders should consider four possible courses of action: minor renovations, extensive renovations, renovations with an addition, and new construction. Each has advantages and drawbacks or difficulties.

Just Minor Renovations

Minor renovations are the least expensive and usually can be done during the summer break. They tend to leave the existing corridors and most rooms in place, though some spaces are reassigned and vacant spaces can be used for new purposes. Air systems are upgraded, often requiring new ductwork and vertical chases to be cut through the building. Violations of the fire code are fixed, and ADA access is improved. There may be some low-cost options, such as refurbishing the existing casework, building new interior windows and glass doors that borrow external light, or changing the lighting and electrical outlets. Usually there is repainting of the interior as well.

A minor renovation does not improve the floor layouts or poor zoning. Offices and separation of faculty remain much as they are. The poor quality of the laboratories also remains, making



Floor plan layouts and circulation systems were usually of two types: the single offset corridor (top) and the "racetrack" corridor.

new methods of teaching science difficult. Little that is visible shows since much of the money is used for unseen systems and minor alterations. It may be hard to find donors to pay for such minor changes to the building.

Such minor renovations may be appropriate for smaller colleges with tiny endowments and at institutions where the sciences and engineering are less important academically than humanities, education, social studies, business programs, and adult education.

Renovating More Extensively

This design option usually involves a reorganization of the building's interior, keeping only the existing structure and exterior skin. The layout of the corridors and rooms may be changed and the program areas rezoned to recover inefficiently used spaces. The new design can address the latest teaching methods, the spatial and electrical requirements of modern technology, and modern mechanical-electrical-plumbing (MEP) systems. What emerges is an entirely new interior that shows off the investment. Donors can be found more easily for these major improvements.

But such extensive renovation usually cannot be done in a summer or around the current occupants of the building. So extensive improvements can significantly disrupt science instruction for an academic year. Surprisingly, the cost of a major renovation usually approaches—or can exceed—the cost of new construction.

Upgrading mechanical systems, creating new teaching and faculty office spaces, introducing sciences like molecular genetics, increasing student research, and meeting modern science building standards will all increase the amount of space needed for science at colleges or universities. Some wasted area can be recovered from inefficiently used spaces in the old Sputnik-era building, but this is usually quite costly. Space within the Sputnik-era buildings is already tight. Additional space is almost always required.

This leads directly to the third option, major renovations with a new addition to the existing science building. The addition can provide the swing space to assist the phased renovation. The addition can also house the elevator that complies to the ADA code and toilet rooms for the entire facility. The mechanical system in the addition can "back feed" into the older portion of the building if access for the routing of the ductwork is available. One clever move is for the vacated elevators or stairwells in the old building to become the new MEP shafts. And an addition allows the highest-tech departments (like biochemistry) to occupy the new space and lower-tech departments to remain in the older building.

Of course, doing both major renovations and an addition to the old building can be very expensive. But fund-raising for a new wing is usually easier. The work is also quite disruptive for a year or two for everyone in the sciences. Yet, if the old building is in a desirable place on campus and is designed and built well, and if there is ground space for an addition adjoining the structure, this option is an excellent one. The key is to evaluate the "fit" of today's technologically demanding science facilities with the constrained structures of the Sputnik era. Almost always the solution is to download the existing building to a less intensive function.

Build It New?

I have come to believe that it is always useful, if only as an exercise, to consider an entirely new building for science on campus, even if that option does not seem feasible initially. The exercise allows an institution and its science professors to create a model of an ideal science facility, and such a model can be very useful in evaluating the compromises of the various renovation options. If the college estimates the costs of its model facility, these costs can become the baseline for evaluating and comparing the costs of the renovations. The model design does not need to be executed. However, thinking about the ideal facility components and arrangements helps everyone focus on the directions and physical needs for science in the coming decades, and it helps campus leaders decide on the priorities for renovation.

A contemporary science building can be hugely expensive, but fund-raising for a spanking new science facility has many advantages. Such a facility helps recruitment of the best students, makes the science faculty happier, and increases the competitiveness and stature of a college or university. It can also increase research productivity and improve the teaching of science significantly.

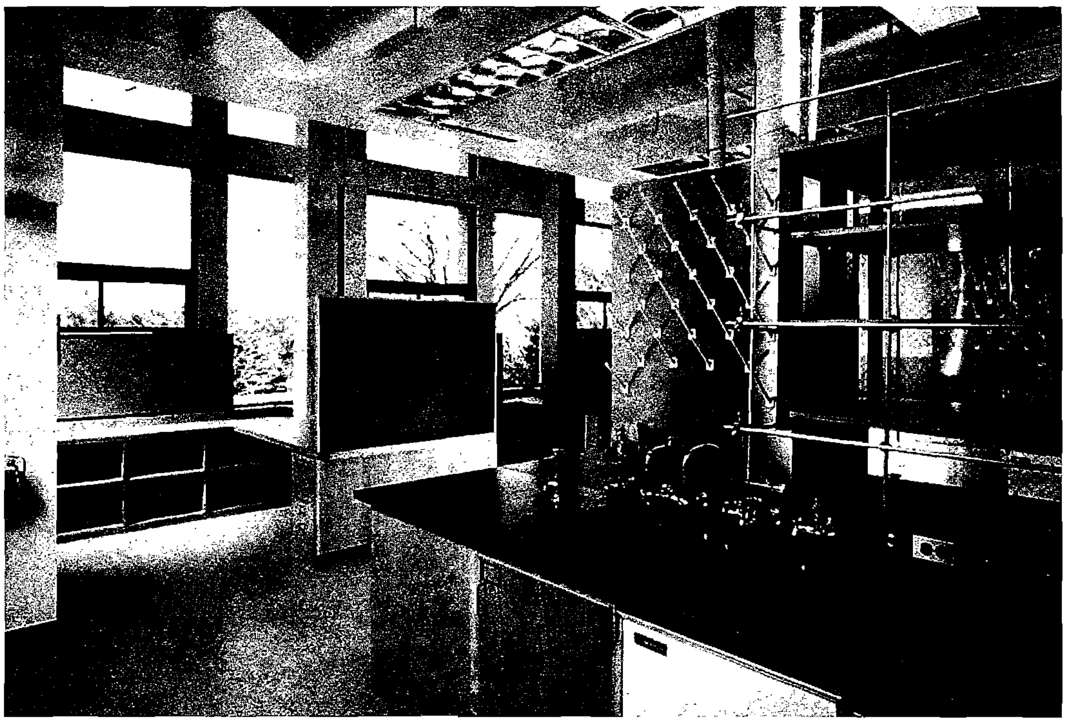
Building a new structure simplifies the move from old to new spaces and minimizes disruption. It also permits a later renovation of the Sputnik-era building into a new home for, say, the humanities group or the arts. Another possibility is use by the burgeoning departments (or new schools) of communication studies.

Clearly, the Sputnik-era science facilities that exist on many U.S. campuses are no longer adequate for today's science, pedagogy, or research. Science has raced ahead, and renovation or new construction is necessary. Planning for college and university science facilities for 20 years ahead requires clear goal setting, careful study, and intelligent, foresightful decisions. The rapid advance of digital technology, computer design capabilities, science instrumentation, and international communication have further complicated—and enriched—the planning for science facilities. Science and technology are two of the most exciting intellectual developments of our time. Higher education must provide them with well-conceived, modern spaces and good equipment. ■

References

Biehle, J. 1996. What Are the Urgent Design Projects? *Planning for Higher Education* 24 (4): 23–26.

Laws, P. 1997. What's Wrong with Undergraduate Science? *Planning for Higher Education* 25 (3): 72–74.



New science facilities, like this laboratory in the Frick Building at Princeton University, can be expensive. However, they can help in recruitment of students, make the science faculty happier, increase the competitiveness and stature of an institution, and improve research productivity and the teaching of science.